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PATENT SPECIFICATION

NO DRAWINGS

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COMPLETE SPECIFICATION

Iridium Alloys

We, INTERNATIONAL NICKEL LIMITED, a British Company, of Thames House, Millbank, London, S.W.1, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

In our Application No. (Serial No. 1016809) 50767/63 we have claimed alloys composed of commercially pure iridium and from 0.1 to 0.5% in all of titanium or zirconium or both. We have found that such alloys have the desirable properties of iridium and that in the form of sheet or strip they are more ductile and more easily butt-welded than commercially pure iridium.

The primary cause of the improvement in butt-weldability is that the alloys have a temperature of recrystallisation of from 1200 to 1300° C, in contrast to the 800° C of commercially pure iridium. This higher temperature of recrystallisation allows the alloys to retain a fibrous structure while being rolled into sheet and this in turn permits them to be sheared to give a good edge.

The method of making these alloys described in our previous Application comprises melting iridium in a zirconia crucible in an atmosphere of argon, adding to the molten iridium a sintered compact of mixed iridium and zirconium or titanium powders containing the requisite amount of the zirconium or titanium, and reheating the crucible to above the melting point of the metal in it. In carrying out this method we allowed a jet of argon to play on the surface of the contents of the crucible but took no positive action to exclude the ambient air.

According to the present invention we exclude oxygen in making such alloys. They may be made in vacuum or in an atmosphere of argon or other inert gas in a sealed chamber. We find that in this way we produce alloys which not only have a high recrystallisation temperature, but also improved properties of strength. Moreover we find that we can now reduce the content of zirconium or titanium or both to as low a figure as 0.005% and still obtain excellent properties. We prefer zirconium to titanium, and we further prefer that the content of zirconium added to commercially pure iridium to form an alloy shall be from 0.01 to 0.3%.

As an example iridium powder and pieces of zirconium wire in the appropriate proportion by weight are melted in a closed furnace in which an atmosphere of argon is maintained. Before the constituents of the alloy are melted, a button of titanium or zirconium is melted in the furnace to act as a getter. The alloy may advantageously be melted in a depression in a water-cooled hearth of the furnace to form an ingot, which may subsequently be edge-forged at 1500° C until the cast structure is completely broken down. Thereafter the forged ingot may be worked to sheet by rolling at 1500° C to 0.1 inch thick and then rolling at 1100° C to the required thickness.

As an illustration of the improvement obtained by means of the invention, an alloy A containing 0.3% zirconium made as described in our previous Application, and alloys B, C and D respectively containing 0.3% 0.1% and 0.01% zirconium and made according to the present invention, were tested for their mechanical properties. The results are given below, together with figures obtained with pure iridium made in an atmosphere of argon by the same method as Alloys B, C and D. In the mechanical tests, the ultimate tensile strength of sheet 0.02 inch thick in the as-rolled condition and after heating to temperatures of 1100 and 1500° C was ascertained. It will be appreciated that if any of the alloys is heated to 1500° C the recrystallisation temperature is exceeded, whereas if the recrystallisation temperature is above 1000° C heating

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to this temperature in, for example, rolling the alloy will not bring about recrystallisation. In addition the Alloys were also tested under stress at 1150° C, and the stress required for rupture in 100 hours was ascertained. The results are given in the Table below.

Alloy	Ultimate Tensile Strength			Stress to Rupture in 100 hours at 1150° C. ton/in^2
	As-rolled ton/in^2	Heated to 1100° C. ton/in^2	Heated to 1500° C. ton/in^2	
A	60	60	18.4	17
B	100	100	41	34
C	92	84	28	24
D	87	75	26	15
Pure Iridium	73	29	28	4

The recrystallisation temperature of Alloy A of our previous invention is about 1200° C. The tensile strength of this alloy when heated to 1100° C was not ascertained but would have been the same as or only a little less than 60 ton/in^2. The recrystallisation temperatures of Alloys B, C and D were all above 1100° C. It will be seen that it is possible to roll any of Alloys A to D to sheet at temperatures up to 1100° C without loss of strength, whereas the strength of pure iridium is much reduced by heating to this temperature. Heating any of Alloys A to D or pure iridium to 1500° C causes considerable loss of strength.

WHAT WE CLAIM IS:—

1. A method of making an alloy composed of commercially pure iridium and from 0.005% to 0.5% in all of titanium or zirconium or both in which the constituents of the alloy are melted in the absence of oxygen.

2. A method of making an alloy composed of commercially pure iridium and from 0.01 to 0.3% zirconium in which the constituents of the alloy are melted in the absence of oxygen.

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